Research

Enhanced podcasting for medical students: Progression from pilot to e-learning resource

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Background. We recorded enhanced podcasts consisting of the lecturer's audio talk and images from the computer screen (usually PowerPoint). The process we used, as well as the software and infrastructure required, are described.

Objective. The study had two objectives: to determine whether undergraduate medical students found enhanced podcasting useful (discussed here); and how enhanced podcasts influenced students' learning (discussed in a separate article).

Methods. We progressed from podcasting a single lecture block of 6 weeks to capturing all lectures for the entire medical undergraduate curriculum encompassing all 6 years, as well as podcasts of clinical tutorials. The podcasts are hosted on a content management system (http://fmhspod.sun.ac.za) for students to view or download.

Results. Student enthusiasm in adopting enhanced podcasts and using them to assist their learning has led to the project developing into a web-based resource for the entire undergraduate medical programme.

Conclusions. Enhanced podcasts are now an essential part of the curriculum. The project has the potential to become self-sustainable by hosting other formerly printed files on the website, thus saving on printing costs.

Afr J Health Professions Educ 2015;7(1 Suppl 1):125-129. DOI:10.7196/AJHPE.505

Podcasting has been used to teach a variety of medical courses. Some authors just produce audio podcasts but others enhance the audio with graphics (such as a PowerPoint slide show). In our study we report on producing enhanced podcasts[1] of the entire undergraduate medical curriculum. We are the first medical school in Africa to do this, and possibly among a few internationally, though there is no evidence of this in the literature. In the rest of this article we use the term podcasts to mean enhanced podcasts.

Background

Students in their second year in the MB,ChB (medical) training programme at the Faculty of Medicine and Health Sciences (FMHS) at Stellenbosch University (SU) faced particular challenges. While still young (average 19 years) they were expected to study more independently, cope with less individual support, and deal with a large lecture and content load. This resulted in students in the second year having a higher failure rate than the rest of the course. The FMHS also has also focused on community-based education and is required to provide learning material to the students on campus as well as for students in rural areas.[2] The FMHS is under pressure to increase the student numbers to address the dearth of human resources for health in Africa.[3] Innovative ways of teaching therefore needed to be explored.

This project was funded by the Stellenbosch University Rural Medical Education Partnership Initiative (SURMEPI) as part of its remit to improve the quality of medical education in Africa. We recorded classes consisting of a combination of the lecturer's voice together with the computer screen (usually a PowerPoint slideshow), known as an enhanced podcast.[1] The project has gone through incremental changes and we cover this by reporting on three phases. Clinical tutorials were also podcasted.

Our two objectives were to explore whether undergraduate medical students found podcasting useful (reported here), and how podcasts influence students' learning (discussed in a separate article in this issue[4]).

Methods

We began with a pilot study (Phase 1) by podcasting the 6-week Respiratory Lecture Block for the MB,ChB 2 class in 2012. At this stage we placed the podcasts on a learning management system (LMS) for students to view or download. Students completed a questionnaire at the end of this lecture block.

During the rest of 2012 we continued to record the entire second year MB,ChB set of lectures (consisting of another six lecture blocks) and made these available on the LMS as well (Phase 2). Another questionnaire was administered at the end of 2012.

In 2013 (Phase 3) we created a faculty website (http://fmhspod.sun.ac.za) to house the podcasts and expanded the project to record all lectures from MB,ChB 1 to MB,ChB 6. At the end of 2013 a formal evaluation was done including all students in all 6 years of the MB,ChB course. The study included a quantitative (online questionnaire) and qualitative component (focus group discussions). An online questionnaire was emailed to all 1 449 medical students. The questions were in the form of Likert responses. We conducted focus group interviews. The qualitative results are reported in the article by De Villiers and Walsh[4] in this edition. The students provided informed consent and ethics approval was obtained (reference # S12/01/022). The data were analysed using Stata for providing frequencies, percentages and various question cross-tabulations.

Technical details of how we produced the podcasts

Before each lecture block, all lecturers received an email explaining the project and requesting their co-operation. We trained students (starting with the MB,ChB 2 class) on how to record the lectures on the lecture

hall computers. In 2013 training was expanded to teams of students in each year (MB,ChB 1 to 6). We used students in each class rather than attempting to get the lecturers to do the recordings as the students' were far more motivated. Also in any given lecture block there could be up to 50 different lecturers. TechSmith Relay (http://www.techsmith.com/techsmith-relay.html) was used on the classroom computer to record the lecturer's PowerPoint slideshow together with the audio input of their lecture. After the completion of the lecture, students submitted the audio and screen recordings over the network to the TechSmith Relay server, where this was converted into an enhanced podcast. The podcasts were edited; a title was added at the beginning and a copyright notice at the end. During Phases 1 and 2, the podcasts were placed on the LMS. In Phase 3 they were uploaded to a content management system (CMS) (http://fmhspod.sun.ac.za) for the students to view and download. The podcasts were usually available to the students within a few hours of the lecture. We used the free DNN Platform (http://www.dnnsoftware.com/) content management system with a Gallery Server Pro extension (http://www.galleryserverpro.com/) for categorising the podcasts by study year and topic (Fig 1).

Each lecture usually lasted 45 - 50 minutes. The podcasts were encoded as MP4 files, with the pixel dimensions of 800 × 600 and audio sampling of 44 kHz. Typically each podcast was 50 - 80 Mb in size, which was similar to podcasts of equal length found on YouTube, TED and other podcast websites. Other researchers have also documented their procedures. Corl *et al.*[5] describe the basic process of producing a podcast, and Jham *et al.*[6] list a number of universities actively doing podcasts. Besides the lecture podcasts, we have also captured numerous clinical tutorial podcasts in: emergency medicine, family medicine, neurology, obstetrics and gynaecology, orthopaedics, paediatrics, psychiatry, rheumatology, surgery and urology.

Students have to log onto the website using their university username and password. They are authenticated by the university's active directory server. Once logged in, students can view or download as many of the podcasts as desired. The podcast files are large, but students on campus are able to connect to the network and download as many of these as they please at no cost. When accessing the website from home they have to use the internet at cost to themselves.

Fig. 1. Arrangement of podcasts by year and subject.

At the end of each phase, students were asked to complete a questionnaire anonymously. The final 2013 focus group interview data are discussed by De Villiers and Walsh[4] in another article in this issue.

Results

Phase 1 – the 6-week pilot study results

At the end of the 6-week respiratory block of lectures, a total of 260 students wrote the end of block examination (2012). The questionnaire response rate was 96%. Table 1 shows how they

Table 1. Phase 1 – students' use of the respiratory block podcasts

Topic	Percentage
Perceived the podcasts to be beneficial	92
Reported using the podcasts	78
Used for clarifying concepts not understood	88
Revision	54
Catching up on missed lectures	38
Exam preparation	30
Assisting with language	13

Table 2. Phase 2 - students' use of the MB,ChB 2 podcasts

Topic	Percentage
Watched the entire lecture podcast	63
Paused the podcast to take notes or skip to areas of interest	34
Just listened to the audio	3
Reviewed podcasted lectures daily	10
Reviewed the podcasts weekly	38

used the podcasts (they could choose more than one category).

We looked at whether the availability of podcasts had affected the module's score. An independent sample *t*-test showed a statistically significant 4% improvement in the class mark between 2012 and 2011. No significant difference was found between the 2010 and 2011 scores.

Given the fact that 92% of the class found podcasts beneficial, we continued to record all the lectures for the MB,ChB 2 students during 2012.

Phase 2 – extending the pilot for all second year MB,ChB lecture results

At the end of 2012 seven lecture blocks consisting of approximately 550 podcasts had been recorded. The questionnaire response rate was 93% (of 260). Students' podcast use patterns are documented in Table 2.

Some also played the podcast at 1.5 times its normal speed, slowing down or pausing the podcast at points of interest. One important issue highlighted was that students required access to the podcasts when they went on to the next lecture block, as well as when they reached their clinical years (MB,ChB 5 and 6). This
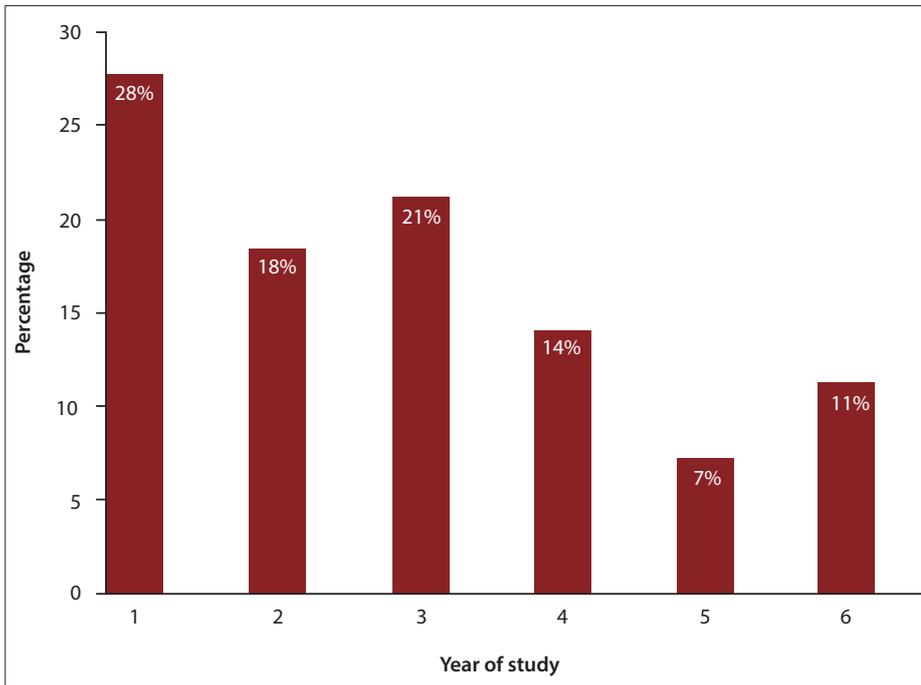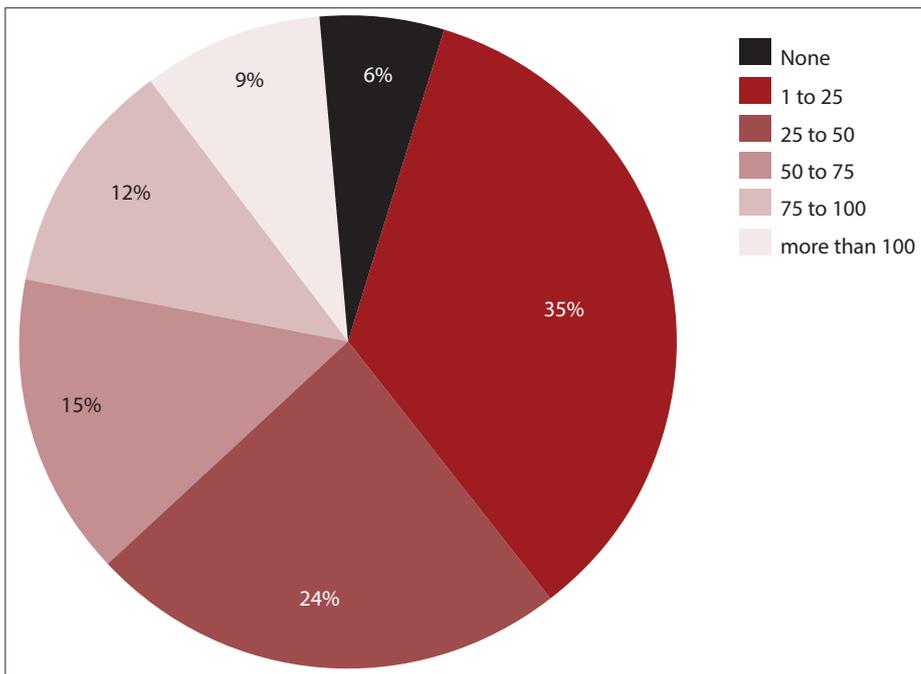
Fig. 2. Responders for each year of study.

Fig. 3. Phase 3 - number of podcasts watched.

Table 3. Phase 3 - preferred study material	
Topic	Percentage
Notes made during the lectures	16
Class notes handed out in lectures	19
Lecturer's PowerPoint slides	20
Text books	13
Podcasts	18
Internet	13

of the MB,ChB course. We had a 39% response rate to our online questionnaire (558 of 1 449 medical students). This was poor compared with the previous two questionnaires, and was probably due to the fact that it was sent out at the end of the year when most students were concentrating on studying for examinations. The breakdown of responders by year of study is shown in Fig. 2. Sixty-six per cent of respondents were female (reflecting the female predominance in the student cohort).

Ninety-four per cent of our respondents had watched podcasts. Most students (60%) accessed them from the campus intranet. Those who did not mostly could not see the relevance for their learning and stated that they attended almost all the lectures. Most students watched numerous podcasts during the year. Fig. 3 gives an indication of how many podcasts the students watched.

In the preclinical years (1 - 4) between 74% and 83% of students reported that the podcasts assisted their learning almost always or to a considerable degree. Podcasts were considered less important in the clinical years (63%).

As a whole, students used a variety of resources for studying (as shown in Table 3).

There was a definite shift in resource use as students matured (Fig. 4). In the pre-clinical phase (years 1 - 4) students preferred to use class note handouts and the lecturer's PowerPoint slides, while the clinical students (years 5 and 6) preferred to use textbooks.

However, when asked which resource they would choose if they only had access to one, podcasting was most preferred (30%), with the lecturer's PowerPoint slides second (24%).

Only 2% of our respondents indicated that they always missed lectures, while 6% frequently missed classes, and these seem to be more of a permanent habit than as a result of the podcasts. Those who missed the most classes also watched the most podcasts. This issue was further explored in the article by De Villiers and Walsh[4] in this edition.
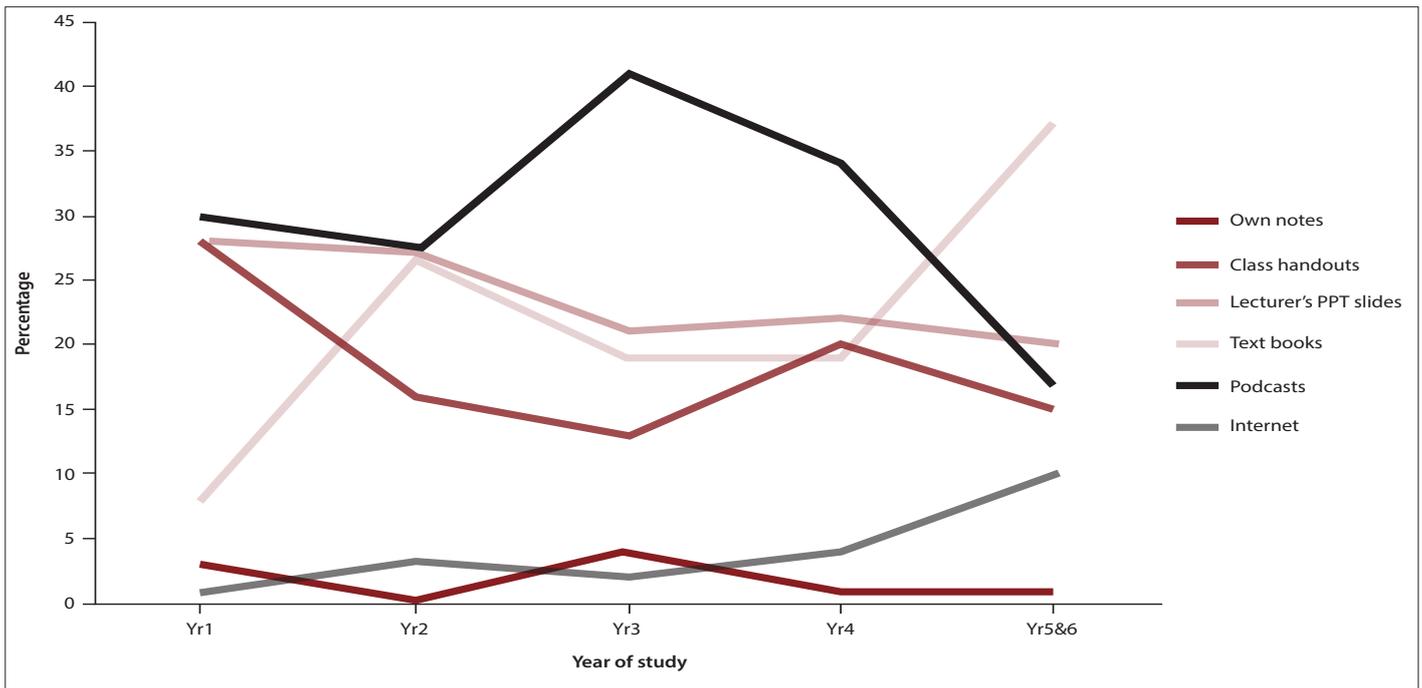
was not possible with the podcasts on the LMS owing to course registration restrictions which locked students out of the LMS once they moved on to the next lecture block. To circumvent this limitation, we created a CMS website where all podcasts were placed (http://fmhspod.sun.ac.za). This went live at the beginning of Phase 3 in 2013.

Phase 3 – Results from MB,ChB 1 to 6 (podcasts for all undergraduate lectures)

Owing to student demand and the strong positive feedback, we extended the podcasting project to include all lectures in the medical curriculum (Phase 3). At the end of 2013 a formal evaluation was done including all students in all 6 years

Fig. 4. Preferred resource.

In summary

Podcasts were found most useful in the pre-clinical years. Our students' feedback shows that they greatly value podcasting for a wide variety of reasons: revision, catching up on missed classes, examination preparation, language issues (the lecture not being in the student's home language) and complementing notes they take in class. Some days students have 6 hours of lectures. Maintaining concentration over this period of time can be rather difficult, so not surprisingly the most prominent use of podcasts was to clarify concepts not fully grasped in class. One student was hearing-impaired and found the podcasts of great benefit because she could turn up the volume. Some just listened to the podcast audio while occupying themselves with other tasks. Most students were selective in which podcasts they watch as they did not have the time to view them all (tantamount to repeating the entire day's lectures).

Discussion

Our students resoundingly confirmed the value of enhanced podcasts for assisting them in learning. Internationally other centres have also found students enthusiastic about podcasts.[7,8] The podcasts are mostly used for clarifying concepts not fully grasped in class. By far the majority of students are also of the opinion that podcasts cannot replace lectures.

Podcasting did not adversely affect the test scores but seemed to slightly improve the class marks although there could have been other contributing factors to this as well. Others have found similar results.[9,10]

Learning Management System (LMS) or Content Management System (CMS)

Our university uses Moodle as its LMS. The LMS contents are tightly coupled to the lecture block, so that when students rotate to the next block they can no longer access material in their previous block. This is mostly to prevent access to test questions.

To circumvent this limitation, we used a CMS which allows us to publish, organise, maintain and edit multiple files, and also allows students 24/7 access to any file from any lecture block.

Copyright

Once produced, copyright of the entire podcast usually belongs to the institution employing the individual, without negating the copyright inherent in the individual graphics, tables, etc. which are included by the lecturer.[11] International, as well as South African, copyright law (Copyright Act 1978) makes 'fair use' exceptions from copyright restrictions for private study or use in research. Fair use enables the work to be used for teaching or research at any educational institution as long as the source and name of the author/s are acknowledged. Users may not make a further copy of the material, sell, alter, reproduce or distribute any part of these lectures to any other person. Making the podcasts available on a website for teaching students who have to login does not expose an institution to copyright infringement. A number of universities have gone this route (University of New South Wales, University of Melbourne, University of Sydney and Monash University, Australia).

Technical issues

Students indicated that they would like to be able to rate individual podcasts by using something such as a star rating or even text comments. To enable this we will be adding more functionality to the website. Having a CMS allows us to expand its uses, and as most students have web-enabled mobile phones or tablets, we plan to host some of the material they currently receive in printed format as PDFs or Word documents. This could potentially save on printing costs and possibly make the project self-sustainable.

Flipped classes

The essence of flipping the classroom is captured by the title of this letter by Kalmey:[12] 'Stop wasting classroom time: embrace the podcast and use the "lecture" to enhance learning'. In a flipped classroom instead of the students sitting in a classroom and listening passively to the lecturer, students review material beforehand and the lecturer uses the class to actively engage the students in a learning experience using discussions around the topic at hand. We see podcasts as one of the foundational enablers in our efforts to implement flipped classes in our undergraduate curriculum. So far we have had very positive student feedback from flipping the dermatology lecture block.

OER and CPD for other medical schools in Africa

Podcasts could be used as open educational resources (OER) and continuing professional development (CPD) material for doctors from a wide variety of disciplines.[13] Having our entire curriculum recorded means we are able to provide updated lectures on all facets of medicine. Content could be tailored to each CPD course by extracting relevant clips from a lecture series and placing multiple choice questions (MCQs) at the end of each podcast. We would like to explore the possibility of allowing other medical schools in Africa (and beyond) to access the podcasts.[14]

Limitations and lessons learned

Although the CMS software is free, it requires a robust server with plenty of storage to host the more than 3 500 enhanced podcasts and other files. The TechSmith Relay software is relatively expensive and requires its own server. All of this software requires a network for lecture hall computers to produce podcasts and to deliver these to the student. So you need people who are experienced in: server administration (usually including VMWare), networks and the maintenance of a content management system such as DNN Platform.

If this seems overwhelming, or you don't have the necessary skills in-house, you can always opt to run everything in the cloud using something like Google's Course-Builder (https://code.google.com/p/course-builder/), Amazon Web Services (http://aws.amazon.com/), Microsoft Hosting (http://www.microsoft.com/hosting/en/us/default.aspx) or if you are a Mac user iTunesU (http://www.apple.com/education/ipad/itunes-u/). These are some of the big players, but there are numerous others offering cloud hosting in each local country or region.

One limitation of our approach is the relatively large files produced by the 45-minute podcasts (80-100 MB). These need a relatively fast intranet or internet connection to view or download. Internet bandwidth can be expensive.

The responsibility for podcasting the lectures has become the remit of students in each class, with little involvement from the e-learning team, except for training new first-year students at the beginning of each year. We realise that the lecturers make up the other half of the podcast equation. We therefore have another study in progress to get their opinions on the podcasting process.

Conclusions

There are two keys to this project's success: student engagement and a content management system.

From the students' perspective, podcasting has become embedded in the way they learn. It has largely been driven by their enthusiasm as they recognised and experienced its benefits. We currently have over 3 500 lectures and clinical podcasts on the website which our on-campus and rural students can easily access at any time. This supports and greatly increases their learning opportunities.

Although administering your own CMS has its challenges, it opens up different modes of supporting teaching and learning that might not be available in a traditional LMS. As lecturers and students become more tech-savvy they can be granted permission to create their own personalised galleries of lesson material. The CMS can also suggest podcasts related to the one the student has currently selected (similar to Amazon's 'Customers who bought this item also bought …' suggestions).

From a pedagogical perspective, podcasting should be seen as a means to encourage lecturers to begin flipping the classroom.

We look forward to exploring opportunities to share our content with other medical institutions on the African continent and beyond.

Postscript. Should you wish to view the podcasts, please email Dr Steve Walsh (walsh@sun.ac.za) with your first name, last name, email and institution.

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